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PPIs and transport infrastructure: Evidence from Latin America and the Caribbean

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ABSTRACT

In the recent past, several governments tried to promote infrastructure investments using different policies and funding schemes. Strategies have been differentiated over time, among regions, and in relation to specific political choices. The paper focuses on Latin America and the Caribbean in which different political approaches have been developed together with a quite different geographical level of characterisation, representing a significant case study to better understand how political and institutional intervention might incentivise local and/or foreign investors, shaping the organisation of the infrastructure network. Therefore, the current research analyses the transport-related projects included in the World Bank database on private participation in infrastructure (from 1980 to 2015) highlighting main patterns in terms of institutional, social and economic characteristics that might influence the investment in transport infrastructure in the Latin America and the Caribbean. Our panel analysis – that includes data collected from the International Monetary Fund, the World Bank and local government websites – shows a clear link between government strategies and the related outcome in terms of transport investments. In particular, in addition to the size of the investment, a positive (and significant) impact of being part of a regional organisation emerges, as well as the involvement of private companies.

1. Introduction

The transport system is a key factor in the developing strategy of a country (Banister and Berechman, 1999). As part of the fixed capital, it favourably contributes, together with macroeconomic stability, openness and the quality of institutions, to determine the investment climate (Stern, 2001). This is important to continuously attract investments and foster economic growth that, under certain circumstances, might determine higher gross domestic product (GDP) per capita and hopefully a more equal distribution of GDP among the population, hence a real social and economic development.

The research for rapid economic development, able to foster efficiency in the domestic industries, has led several developing and emerging economies to attract private (foreign) companies to speed up the modernisation of the main economic sectors. The potential positive effects of attracting both the know-how and the capital of private operators have been widely documented either by literature (e.g., Aschauer, 1989; Araujo and Sutherland, 2010) or official international reports (e.g., IMF – International Monetary Fund, 2016). Therefore, many countries have opened local markets to foreign companies to attract new capitals or build up joint ventures to transfer not only funds but also technologies and know-how (Roumboutsos, 2016).

Despite a general agreement on the positive effects of this process, some authors (e.g., Bogliaccini and Juan, 2013) argued that market openness in certain world regions, such as Latin America, had a downward effect in increasing internal inequalities. Despite this, Wacziarg and Welch (2008) demonstrated that, from 1950 to 1998, market openness and capital investment determined average annual growth rates higher than before liberalisation. The debate on the effects of market liberalisation and economic openness on a certain region has been investigated only partially and linked to the economic structure of many developing countries. Since many of these countries base their economy on export-oriented industries, the regional endowment of infrastructures impacts their international trade. For this reason, Wilmsmeier et al. (2006) emphasise how the presence of specific transport infrastructure (i.e., seaports) may influence the international transport connectivity and the role of a region into the international trade network. Apart from specific benefits related to the openness to international markets, economic literature deeply discussed the beneficial role of infrastructure endowment on the local or domestic

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economy (e.g., Ottaviano, 2008; Crescenzi and Rodriguez-Pose, 2012) in terms of cost savings or increased productivity. Moreover, there is the possibility of achieving spillover effects on wider areas (e.g., Holtz-Eakin and Schwartz, 1995; Bottasso et al., 2014); similar results are also coherent with the New Economic Geography approach (e.g., Krugman, 1991).

In general, transport investments are considered a leverage to foster international trade and provide a basis for promoting internal growth. This issue is even more important for developing countries that, due to a lack of funding, have been promoting different and innovative kinds of investment policies in accordance with specific institutional choices. In fact, while literature has often investigated the causal relation between transport choices and government prescriptions (e.g., Verhoef, 2000), the effects of institutions (e.g., governments and regional authorities) on transport investments and transport network have been considered only recently. An example of this issue is represented in Europe by the Trans-European Network-Transport TEN-T framework (e.g., Gutierrez et al., 2011).

Nevertheless, while the link between the role of institutions in transport development has been addressed (at least partially) in many industrialised regions (e.g., Gutierrez et al., 2011; Kemmerling and Stephan, 2008), showing the beneficial role the institution can have in terms of promoting transport system integration and planning, not many studies focused on the effects of institutions on transport investments and how these investments can foster regional economic wellness in developing regions (e.g., Banister and Berechman, 1999; Short and Kopp, 2005). The current study contributes to filling this gap by studying a geographical region, Latin America and the Caribbean (LAC), hat experienced different forms of governments and institutional influences in the past decades. Thus, being able to understand the role of different national and international institutions in promoting a regional transport project can help in generating improvements in both planning activities and the efficiency of the overall resource allocation. These two elements can positively affect the overall level of regional integration.

The goal of this paper is to investigate the effects that regional institutions had on the transport network and how these institutions influenced the attractiveness of the region for private operators and external partners influencing the regional transport system. In order to achieve the abovementioned goal, data from international organisations and local governments have been collected for the past 36 years (1980–2015) from Latin American and Caribbean countries. In order to collect the dataset, the World Bank database on Private Participation in Infrastructure will be used because it is the main international information source for infrastructural PPIs in developing countries. Other public sources (e.g., the IMF and government websites) have been used to collect main macroeconomic (e.g., import, export, GDP and population) and political (e.g., government and international cooperation agreements, such as Mercosur and World Trade Organization (WTO) data. The analysis will consist of a panel regression aiming at investigating the effects of institutions on transport investments and on the development of the transport network in the studied region. The geographical scope of the research focuses on Latin America and the Caribbean for both the different political experiences made during the period (with military and right- and left-wing governments) and the countries' participation at regional and international trade organisations.

The paper is organised as follows: After this brief introduction, Section 2 focuses on the main issues related to PPIs and government choices, and Section 3 describes the geographical scope of the paper. Section 4 discusses PPIs in Latin America, while Section 5 introduces the regression analysis. Section 6 presents the results of the research. Finally, Section 7 addresses the conclusive remarks and discusses potential future research.

2. Background

Infrastructure investments can be fostered through different policies, including public initiative, private intervention and international collaborations. Given the fact that many developing economies need funds and know-how, several international reports (e.g., Makovsek et al., 2014; OECD, 2013) have suggested PPIs as an important instrument to develop public infrastructure and exploit the economic potential of a region.

According to the World Bank definition (WB, 2007) public–private partnerships (PPPs) (often another name to define PPIs) are agreements or contracts between the public and private sectors to jointly operate and/or own infrastructure projects. These partnerships relate to several sectors (e.g., telecommunications, energy and transport) and may be addressed to the management and/or construction (/renewal) of an infrastructure. As suggested by Hall et al. (2003), the fact that PPIs can also involve already built infrastructure makes PPPs a substitute of the more traditional privatisation processes (mainly for political and ethical reasons) to allow the private sector to enter the management of public infrastructure. For this reason, several reports (e.g., WB, 2007; Araujo and Sutherland, 2010; UNESCAP, 2011) often neglect the distinction among PPP, PPI, private finance initiative (PFI) and private sector participation (PSP); all of these terms are used to describe the same situation. Specific distinctions among the abovementioned terms are due to different contractual obligations of either the public or private party and on the need to just manage or build the related infrastructure. For the purpose of our study, and also as mentioned in the World Bank database (WB, 2007), we will use the term PPIs (and PPPs) as a broad set of collaborations between public authorities that aim to involve private actors in the management and/or the construction of an infrastructure.

Moreover, the kind of private involvement in the projects may differ in several contexts and so the infrastructure may be either completely private or public at the end of the “partnership”. It is important to distinguish PPIs from foreign direct investments (FDIs): PPIs might be included in the FDIs if (at least) a private partner is represented by a foreign company, even if this is not always the case.

Furthermore, several authors (e.g., Chou et al., 2015; Chou and Pramudawarhani, 2015; Aerts et al., 2014; Tang et al., 2010; Medda, 2007) discussed potential critical issues related to the PPIs, such as investment risk management and the relationship among the investors and the project governance organisation. For this reason, different sectors are characterised by different structures of PPIs, having different elements of characterisation (e.g., Gangwar and Raghuram, 2015; Panayides et al., 2015; Meersman et al., 2014). Nevertheless, since the most important role of PPIs is fostering regional investments, this investment tool seems appropriate as a proxy to investigate transport network development within a specific region.

Concerning the regional transport network, different studies pointed out the potential benefits of improving the role of certain nodes (or regions) within international networks (e.g., Ducruet, 2013). Additionally, according to Cherif and Ducruet (2016) and Wang and Ducruet (2014), regional institutional and industrial backgrounds affect both local planning and the presence in international or local network. Thus, transport policy can affect regional development and presence in international trade. The importance of considering regional aspects in contemplating transport investment has been underlined also by Wilmsmeier and Monios (2016) when discussing the port policy of a sample of Latin American countries and how path dependency can affect transport and economic development. For this reason, the current study will focus on transport investments (in terms of PPIs) and some socioeconomic regional characteristics in order to better understand the role of regional and national institutions in fostering the local transport network.

Latin America and Caribbean have been also studied in relation to their involvement within the main trade routes that recently fostered

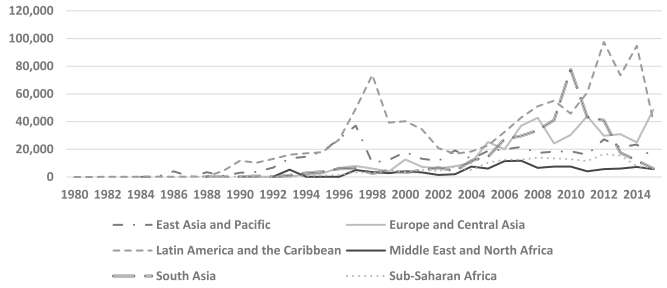

Fig. 1. Trend in PPIs worldwide.
Source: World Bank PPIs Database, 2016. Data in millions of US$.

the regional economic development. Both Wilmsmeier and Martinez-Zarzoso (2010) and Ng et al. (2013), for instance, underlined the difficulties in terms of infrastructure management and investment provision of many regional countries that are currently struggling – in terms of performance – in coping with industry needs, often generating extra-costs for the trading companies.

Fig. 1 demonstrates the importance of PPI projects worldwide by showing the growing trend of the value of this kind of investment. While the figure summarises different kinds of projects, a similar value can be collected concerning only the transport sector. Data highlight that Latin America and the Caribbean account for the majority of the projects, followed by South Asia and East Asia, respectively. Concerning the role of single countries, it is worth mentioning that in every region, main countries attract the majority of the funding; therefore, Brazil and Mexico together register 60% of the overall value for the studied region.

Regarding the role and openness degree of a specific country in the world economy, Wacziarg and Welch (2008) suggested an openness indicator given by the ratio between the sum of imports and exports and the GDP. Fig. 2 shows this indicator together with the value of the PPIs in Latin America and the Caribbean for the transport sector. As shown in the figure, general openness decreased during the first years of the 1980s (mainly due to a strong reduction of imports during 1980–1985). After that period, with the exception of a few peaks, this openness stabilised on a growing trend (with the average growth rate of both exports and imports two times higher than that of the GDP). Moreover, until the mid-2000s, the openness value seems correlated with the PPIs. Even if starting from 2009, the growth continued independently. Thus, it is fair to say that at the beginning of the studied period, the closure of many countries – openness decreasing period – affected the transport investments – and then the PPIs, with a value close to zero – while the market liberalisation and the increasing openness modified the institutional framework, increasing the need for efficient transport solutions and then PPIs in the transport sector, as shown in Fig. 2.

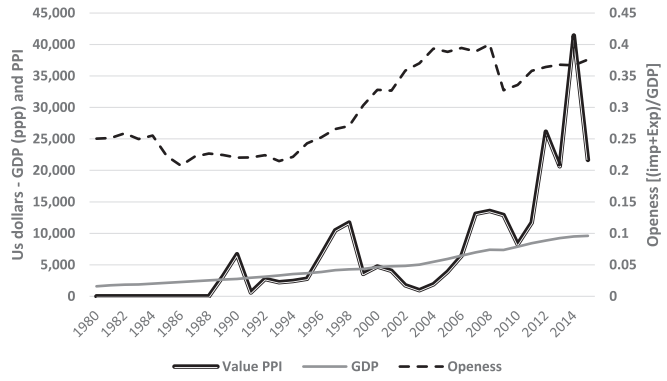

Fig. 2. Comparison between Openness degree and PPIs value.
Source: Own Elaboration on IMF and WB data, 2016.

3. Data and geographical scope

The passage from investment to development is not immediate; it is "intermediated" by several factors and conditions that have been widely discussed (and still are today) in literature. At the same time, the complexity of the whole process makes general and theoretical economic rules, that necessarily have to abstract from a particular economic context, not so much useful to predict the economic consequences of any economic intervention. Therefore a case study approach represents a good complement to the macroeconomic studies.

As mentioned earlier, the geographical scope of this paper is Latin America and the Caribbean, as defined by the United National macro-regional classification. This region comprises more than 30 countries, even if the list varies depending on the international organisation listing the countries (mainly because of the possible exclusion of some island states and other territories). It is important to emphasise that in all of the main lists of the Latin American and Caribbean countries, Cuba and Puerto Rico are normally included. Nevertheless, due to a lack of reliable data, these two countries are excluded from this analysis. Fig. 3 shows the country location and main PPI project development.

Furthermore, countries belonging to this region are located in three different subcontinents (i.e., North, Central and South America), and they are quite heterogenic in terms of economic, geographical and social characteristics. Thus, the sample is characterised by big countries (e.g., Argentina and Mexico) and small countries (e.g., Antigua and Barbuda), together with countries having emerging economies (e.g., Brazil) and those with developing economies (e.g., Chile). Similarly, considering the Human Development Index (UNPD, 2016), the range of country development seems quite heterogenic (with "developed" countries, such as Chile, and "underdeveloped" ones, such as Haiti). Specifically, the sample of countries includes 9 island states, 12 South American countries, 1 North American country, and 14 Central American and Caribbean countries. Moreover, another cultural factor of differentiation is the language in which most of the countries have as a common mother tongue (i.e., Spanish); however, nine states are not Spanish-speaking countries, and the majority of these countries are English-speaking countries.

In addition, this heterogeneity is well demonstrated by the different political characteristics, as shown in Fig. 4. The figure presents the duration (in years) of governments ruled by left- and right-wing parties, as well as other forms of governments (e.g., military government). In fact, while many studied countries were ruled by military during the 1980s, this trend has been modified over the years with a differentiated structure during the 1990s, the predominance of a socialist coalition in the 2000s and the presence of many conservative governments lately. Fig. 4 also shows that the first PPIs were supported mainly by conservative parties (more related to the idea of traditional liberalism); however, starting in the 2000s, PPIs grew exponentially, even if the majority of governments were more socialist (traditionally less inclined to involve private and international companies).

The political differences among the studied group of countries also affect their participation in the main regional and international trade organisations. While many South American countries participate in either the Mercosur Community (established in 1991) or the Andean Community (established in 1969), the other countries struggle to be part of common regional communities that foster regional cooperation. Thus, Mercosur appears as the only regional form of cooperation in terms of common regional economic policy aimed at promoting trade and investments. Concerning this organisation, Venezuela and Bolivia have recently joined the four Mercosur founders (i.e., Argentina, Brazil, Uruguay and Paraguay), forming a larger form of the organisation in the region. In terms of international cooperation, almost all of the countries entered into the WTO in 1995, benefiting from this kind of cooperation since the beginning. Thus, from an institutional point of view, international institution appears all the same for the majority of

Fig. 3. PPIs spatial distribution.
Source: Own Elaboration based on WB database, 2016.

the countries, but they differ in space and time in terms of internal and regional policies.

Considering the main statistics of the studied countries, Table 1 shows the average value of the main economic statistics of the analysed countries from 1980 to 2015.

It is quite evident that the countries' main economic variable varies considerably among each country, with the South American countries and Mexico representing the vast majority of the population and economic value of the whole area. Despite this, many countries registered a high level of growth during the past decades and a high value of human development indexes (UNDP, 2016).

4. PPIs in Latin America and Caribbean

Concerning the PPIs considered in this study, starting from 1980, the number of transport projects in the region grew considerably from only 1 project per year in the 1980s to more than 40 projects per year during the past decade. In total, more than 960 projects are included in the study for a total value of approximately $246 million (USD). Among the studied projects about 60 of them have been delayed or even cancelled over the studied period).

Fig. 5 shows the distribution of the PPIs among the studied countries. Brazil accounts for more than 40% of the overall number of projects, while for four other countries that share is similar and around 11% of the overall value. The remaining 10% of the projects are distributed almost equally among the remaining countries (even if a few of them did not register PPIs in the studied period, such as Antigua and Barbuda, Suriname and El Salvador).

Regarding the mode of transport developed through the PPIs in the studied period, it is clear from Fig. 6 that a large part of the initial sum invested through the PPIs is directed to develop seaports and roads; only later have PPIs been used to improve the railway sector.

Looking at the countries and transport projects involving PPIs, it is significant that in the region, the following five countries concentrate almost the totality of the value of the all PPIs (in order of the value of the total investment): Brazil, Mexico, Colombia, Argentina, Chile and Peru. Moreover, in the case of the railway sector, about two-thirds of the investments have been developed in Brazil, while there is not spatial concentration for the kinds of infrastructures. In a few cases, unsolicited projects are also present. This last fact means that some private

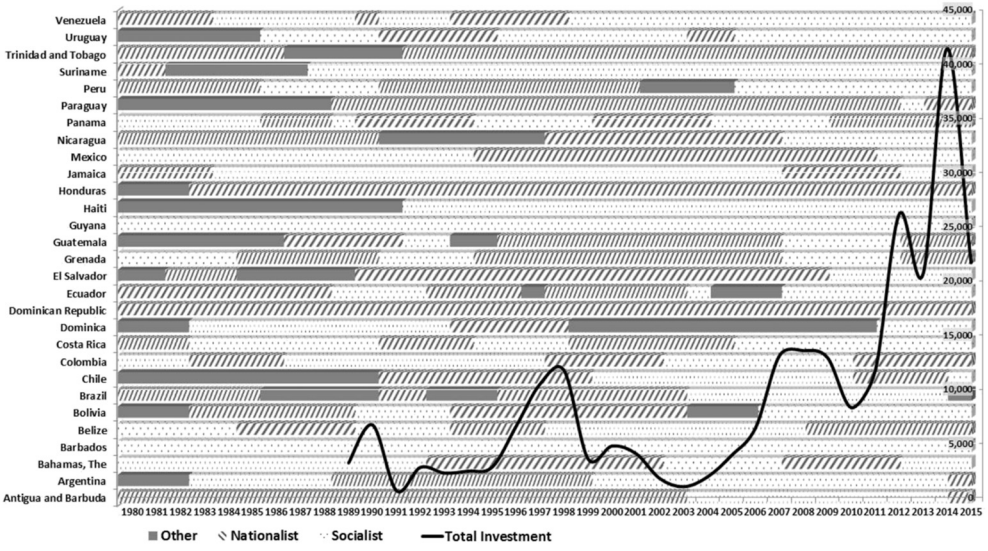

Fig. 4. Governments and Investment trend.
Source: Own Elaboration based on public government data, 2016.

Table 1
Country statistics (period 1980–2015).
Source: IMF, 2016.

	Export	FDI abroad	FDI in	GDP PPP	Import	Pop
Antigua and Barbuda	0.05	0.00	0.06	1.14	0.36	72,944
Argentina	31.07	0.73	4.26	454.27	26.10	35,590,778
Bahamas, The	1.33	0.00	0.22	5.49	2.78	289,389
Barbados	0.31	0.02	0.11	2.91	1.06	263,611
Belize	0.18	0.00	0.04	1.33	0.43	242,889
Bolivia	2.89	0.00	0.32	30.79	2.74	8,041,806
Brazil	87.57	4.41	20.52	1641.10	78.45	164,464,472
Chile	28.37	3.09	5.92	177.63	25.96	14,693,472
Colombia	18.03	1.21	3.86	289.48	19.61	38,533,778
Costa Rica	4.98	0.08	0.70	31.59	6.86	3,623,750
Dominica	0.04	0.00	0.01	0.44	0.13	71,457
Dominican Republic	1.52	0.01	0.79	57.29	6.89	7,982,361
Ecuador	8.12	0.00	0.32	82.89	8.35	12,103,361
El Salvador	3.21	0.02	0.22	27.69	6.18	5,700,417
Grenada	0.03	0.00	0.04	0.72	0.20	100,389
Guatemala	2.92	0.00	0.28	57.18	6.00	10,962,333
Guyana	0.55	0.00	0.06	2.71	0.73	741,833
Haiti	0.35	0.00	0.03	11.42	1.17	8,217,917
Honduras	1.65	0.01	0.32	18.36	3.54	5,931,333
Jamaica	1.24	0.01	0.28	16.04	3.32	2,508,306
Mexico	147.77	3.16	12.15	1139.77	158.17	96,177,528
Nicaragua	0.86	0.01	0.22	14.35	2.17	5,454,045
Panama	0.69	0.15	1.07	29.77	4.38	2,927,694
Paraguay	2.76	0.01	0.11	26.70	3.89	5,086,139
Peru	13.63	0.06	2.47	156.93	12.80	24,465,722
Suriname	0.85	0.00	0.00	4.31	0.77	483,538
Trinidad and Tobago	5.64	0.11	0.46	21.36	4.04	1,251,389
Uruguay	3.24	0.01	0.64	33.70	3.96	3,203,722
Venezuela	34.80	0.51	1.47	294.30	20.39	22,898,528

Monetary value are in billions of current US$.

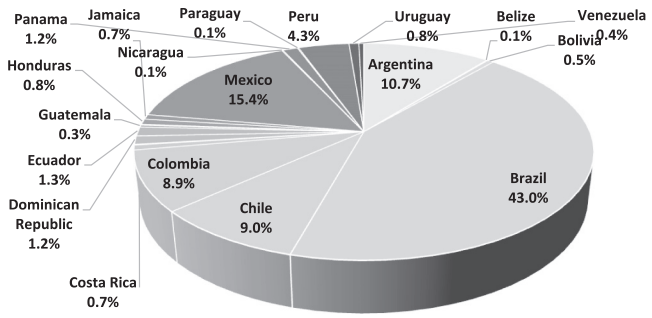

Fig. 5. Distribution of PPIs in the transport sector.
Source: Own Elaboration from WB data, 2016.

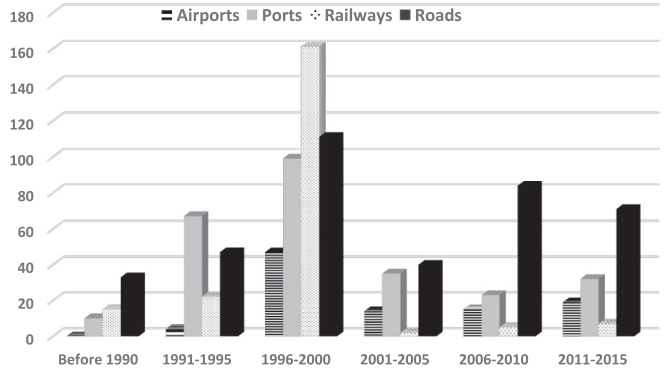

Fig. 6. PPIs per mode of transport and year.
Source: Own Elaboration from WB data, 2016.

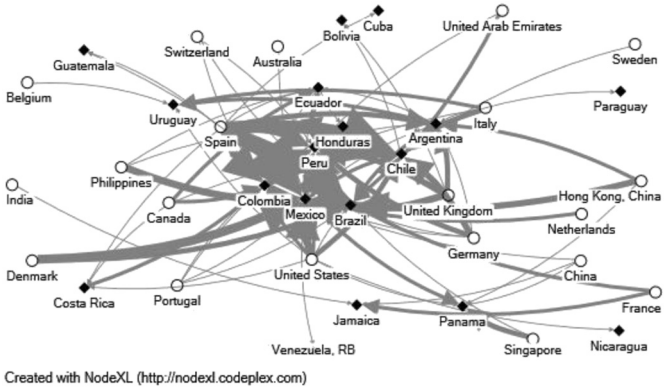

Fig. 7. Latin America and Caribbean PPIs' Network.
Source: Own Elaboration based on WB database, 2016.

operators are proactive in terms of promoting PPIs and then investing in specific infrastructures (mainly ports).

As anticipated above, PPIs can be used to foster private intervention or foreign investments. Both of these elements appear quite different in the studied countries, with approximately 40% of the projects involving a foreign partner while the majority of the projects registering private participation as a minority of the overall investment value. Furthermore, it is important to emphasise that looking at the PPI data segmented per mode of transport (i.e., road, rail, air and sea), a bigger proportion of the earlier investments was dedicated to international nodes, such as seaports and airports. However, in a second phase, the main focus of the investments is connected to internal infrastructure, such as rail and road networks.

Generally, investments in the transport network have an essential role in enhancing intraregional integration and international cooperation. Looking at the cooperative network fostered by the link between the location of the investor and the related beneficiary, 38 countries can be identified. Of those countries, 20 of them are investors, while the remaining 18 are net beneficiaries. Approximately three-quarters of the monetary flows generated by the 90 edges of the network (Fig. 7) move from a high-income country to a developing country, but the remaining quarter is made of flows across two developing countries. In general, each investing country has selected a limited number of beneficiaries (from one to four) to which they direct their economic interests (as testified by the out-degree index). China (including Hong Kong) registers PPIs in six Latin American and Caribbean countries, and Germany registers PPIs in five countries. However, the United States and Spain invest in 10 LAC countries. The reasons behind these last figures seem quite clear: for the United States, geopolitical reasons as the spatial proximity to the Panama Canal, one of the main gateways of international trade, and the cultural and traditional closeness for Spain.

Moreover, it seems notable that 2 countries (i.e., India and the Philippines) out of 20 investing countries (not belonging to the Latin American and Caribbean region) are classified by the World Bank (in the list released on December 2016) as lower middle-income countries; China is an upper-middle-income country, and the remaining 17 countries are high-income countries. The link demonstrates the degree of cooperation that PPIs can foster among a variety of different countries.

Among the beneficiary countries, the analysis of the in-degree indexes shows that the most active countries are Brazil and Peru (index equal to 12), followed by Mexico and Colombia (index equal to 10). These four countries group half of the country pairs. Moreover, Mexico and Argentina are the countries more investing in Latin American and Caribbean countries, in seven and five LAC countries, respectively. These last figures show how PPIs are fostering international cooperation outside the region and how they are used to promote a transformation of the macro-regional transport system to increase the overall

transportation supply and regional connectivity. Thus, while it is easy to identify the role of PPIs in the transport system, the role of a government initiative in increasing regional connectivity is worth of further investigations.

In order to achieve the goal of the study, PPIs will be used as a proxy to the transport investment policy of a certain state. Economic and social variables are listed in Table 1, while other institutional variables are tested, including policy characteristics (i.e., the type of government, the participation of specific regional organisations and a presence in the WTO), cultural elements (i.e., language) and geographical characteristics (i.e., island state and location in South America). Moreover, institutional choices in terms of PPIs have been tested in terms of private participation in the project and the involvement of at least one foreign partner in the project.

5. Government influence

While PPIs and economic and social variables vary over time following a specific trend (as well as the government-type variable), other institutional and geographical variables are binary elements that work as activating factors if and when a country registers a specific characteristic (i.e., participation in Mercosur). Data have been collected from the World Bank (PPI-related information), the IMF (economic and social statistics) and government websites (e.g., politically related information).

Table 2 presents all of the variables that have been tested.

Other variables have been collected (e.g., specific forms of PPIs and other regional agreements), but the low level of reliable information and the minimum amount of common records suggested to avoid further characterisations. Moreover, it is important to underline that the IMF released an openness indicator (more related to the economic liberalisation); however, since it covers only the last 15 years, the indicator has been replaced by a ratio similar to those estimated by Wacziarg and Welch (2008).

All the data were collected for the overall studied period, which allowed us to develop a panel regression analysis and consider the changes of the variables for 29 countries in the 36-year period (1980–2015). Thus, the total number of observations amounts to 1044 records. The fact that some time-varying variables register only a few modifications over the different periods (e.g., the government) has been taken into account in the analysis development for the implications that this can cause to the analysis.

As for a standard panel regression (Arellano, 2003; Baltagi, 2013), some methodological problems could arise in terms of the heterogeneity, heteroscedasticity and autocorrelation of variables. The general panel definition is the following:

$y_{it} = \alpha + \beta' X_{it} + u_{it}$ with $i = 1, 2,\ldots, 29$ and $t = 1, 2,\ldots, 36$

i represents the number of countries, t signifies the time period, y stands for the dependent variable (i.e., PPI in transport), and X represents the set of independent variables.

Panel models can differ depending on the assumption on u_{it}. According to this assumption, different kinds of panel regression can be utilised. Depending on these assumptions, pooled Ordinary Least Squares (OLS) are a viable solution, but fixed effect (FE) or random effect (RE) models can be considered more suitable to achieve the results of the analysis. The main differences among the two latter models rely on different assumptions of the effects of u_{it} in the estimation. In general terms, where N is large, u_{it} could be considered as effects with a random distribution acting as independent variables (i.e., RE) more than unobserved constants (i.e., FE). Thus, in the FE models, $u_{it} = u_i + v_{it}$ in which the first term represents the constant observed effect that is time independent for the correlated variable, while the second term fulfils the usual condition on errors. Since the RE model assumes that covariates and effects are approximately independent and cannot be guaranteed by the used variables, we assumed the FE model as the standard tool to perform our investigation. Moreover, the use of the FE model helps to avoid multicollinearity issues to evaluate country-specific effects. Eventually, one of the outcomes of the model is the evidence of a within and between variance that investigates the variation related to specific subgroups instead of among elements included in the same subset of the factors. A reduced within variation is normally considered a good element of fitting. Moreover, several tests have been performed on different alternatives to better understand the differences among specific variables and their effects on the investment performed on the transport network.

Among the different tested models, one pool OLS is shown (Model 1) in which the dependent variable (i.e., the number of PPIs) has been connected to several geographical and institutional variables, showing how the market openness (in terms of participation in interregional trade organisations, foreign intervention in the PPI and participation in the private sector), geographical conditions and type of government can affect the investments in the transport network. Models 2–8 show the results of the FE models mixing different independent variables. In particular, the dependent variable in Models 2–5 is the number of PPIs, while the dependent variable in Models 6–8 is the annual value of the project in the referred country. Since there was a different nature of the dependent variable, there was no sense in using the same set of independent variables for the two different dependent variables. Despite

Table 2
List of considered variables.

Variable	Meaning	Characteristics	Variable	Meaning	Characteristics
Count	State	n.a.	Pop	Population in the reference country	Millions of people
Y	Year of reference	1980–2015	South	Location in South America	Dummy variable
CAN	Participation to the CAN in the reference year	0 = not member, 1 = member	WTO	Participation to the WTO in the reference year	Dummy variable
Export	Value of exported goods and services	Billions of US$	Govt	Type of government in the reference year	0 = other form of government, 1 = right wing party, 2 = left wing party
FDI_Abroad	Value of the FDI abroad by a certain country	Billions of US$	PPP_tot	Number of projects in the referenced country	Absolute value
FDI_IN	Value of the FDI received by a certain country	Billions of US$	PPP_tot-VALUE	Value of projects in the referenced country	Value of US$
GDP_nom	GDP at nominal value	Billions of US$	Private_perc	Average Percentage of Private participation in the PPI	Ratio
GDP_PPP	GDP at purchase power parity	Billions of US$	Foreigners	Average Percentage of Foreign participation in the PPI	Ratio
Import	Value of imported goods and services	Billions of US$	Openess	Ratio between the sum of Import and Export with the GDP nominal value	Ratio
island	Being an island state	Dummy Value	no spanish	Being a no-Spanish speaking country	Dummy variable
Mercosur	Participation to the Mercosur in the reference year	Dummy variable			

Table 3
Results of the performed analysis.

	Pool OLS - Number of PPIs	FE - Number of PPIs				FE - PPI Value		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
const	− 0.0260	− 0.128	− 0.099	− 0.947***	− 2.155***	− 232.225	396.850***	354.388***
	0.21	*0.169*	*0.163*	*0.22*	*0.225*	*132.139*	*135.586*	*2.981*
Private	0.059***	0.037***	0.039***	0.027***	0.024***	− 1.462		− 1.58415
	0.003	*0.002*	*0.003*	*0.003*	*0.003*	*1.611*		*− 1.0411*
Govt	− 0.0004	0.288**	0.145	− 0.010	0.035	32.287	4.045	
	0.116	0.115	*0.111*	*0.099*	*0.092*	*54.163*	51.503	
Foreigners	− 3.081***		− 1.370***	− 0.899***	− 0.549*	309.47		375.081**
	0.44		*0.388*	*0.345*	*0.323*	*189.49*		*2.093*
Mercosur	2.724***		3.048***	1.382***	1.022***	− 262.749		− 616.43***
	0.314		*0.354*	*0.331*	*0.314*	*184.188*		*− 3.490*
Pop				0.068***	0.165***	12.22	− 57.790***	− 54.238***
				0.012	*0.014*	*8.079*	*9.768*	*− 5.491*
WTO	− 0.304		− 0.259	− 0.021	− 0.170	− 14.4282		
	0.478		*0.396*	*0.351*	*0.324*	*190.42*		
Import					0.039***	17.580***	28.755***	24.947***
					0.011	*6.284*	*5.89*	*4.25*
Export					− 0.0747***	− 27.049***	− 51.134***	− 49.717***
					0.011	*6.674*	*6.516*	*− 7.709*
FDI_Abroad					− 9.735***	− 0.012		
					0.001	*0.02*		
FDI_IN				0.001***	0.001***	0.191***	0.149***	0.151***
				0	*0.001*	*0.009*	*0.008*	*18.654*
CAN	− 1.160***							
	0.249							
island	− 0.101							
	0.205							
south	0.449**							
	0.228							
GDP_PPP							5.027***	5.423***
							0.503	*10.655*
LSDV R-squared		0.59	0.62	0.7	0.75	0.6	0.64	0.64
LSDV F(38, 1005)		47.71	50.19	68.47	78.31	39.85	51.65	50
P-value(F)	1.90E-121	1.00E-170	1.50E-187	7.40E-239	1.90E-270	2.70E-172	1.00E-194	1.20E-196
Within R-squared	0.43*	0.23	0.29	0.45	0.53	0.51	0.55	0.56

this, Models 5 and 6 represent an exception to this statement. Table 3 shows the main results of the analysis. The columns in the table distinguish different models (i.e., as anticipated or differ from each other either for the type of estimation or the applied set of variables), while the rows include the variables contained in the model. Empty spaces mean that the specific variable is not included. For instance, Model 1 represents a pooled OLS in which the independent variables are private participation, government type, the presence of foreign companies, participation in the Mercosur or Andean communities and being located either in an island or in South America.

6. Results

Table 3 shows how pure geographical factors are rarely considered since they are often not significant. Despite this, Model 1 shows positive significant effects for the “south” element, underlining the possibility of a positive effect of certain geographical characteristics on the capability to promote PPIs in the transport sector.

Nevertheless, institutional factors are often significant with the capability of attracting foreign and private capitals and the participation in regional organisation that always have significance. It is interesting that private participation normally registers a positive coefficient in connection with the number of PPIs and a negative coefficient for the value of the projects, while foreign participation is characterised by the opposite signs. These findings seem to emphasise how specific categories of investors are likely to be specialised in either big or small projects with governments that probably prefer to promote foreign participation in big projects; however, they normally are more willing to assure more projects (in terms of quantity) to domestic firms. At the same time, big projects tend to have higher public participation in comparison with small investments. Similarly, the participation in international organisations is significant only for regional institutions (e.g., Mercosur) with a general positive coefficient related to the number of PPIs but not to the value of the projects, again probably in connection with the willingness of the governments to foster several small projects within the regional cooperation instead of big strategic investments. Concerning local institutions, the variable “Govt” is not often significant, but it generally has a positive effect on transport investment. The overall results of the institutional elements seem to confirm the great role of government and institutions in attracting private capital and in fostering the development of the national transport network. Moreover, a differentiation in terms of specific investors also seems to be linked to the possibility that governments may prefer different kinds of partners in relation to specific investment typology.

Considering economic values, all of the variables related to international trade normally have great effect on the transport investments, and our estimations confirm this fact. Table 3 does not show the models utilising the openness indicator because it is more interesting to note the different effects of the import and export variables: while the former usually has positive coefficients, the latter negatively affects the PPIs in the transport sector. This result confirms that exporting countries already have a sufficiently reliable network of infrastructures, while importing countries need to upgrade their existing transport network to facilitate international trade, reduce their dependence from imports in some cases and acquire needed resources and goods. Other general variables, such as GDP and Population, are significant, and the signs of their coefficients are as expected. Therefore, the willingness of governments to open their economies to international trade is confirmed to be a relevant factor for the investment in the transport network; however, with different effects for export oriented or import dependent

Table 4
Results of the performed analysis (excluding Brazil).

	Pool OLS - Number of PPIs	FE - Number of PPIs		FE - PPI Value	
	Model 1	Model 2	Model 4	Model 6	Model 7
Const	0.12	0.227**	− 0.107	− 106.777	− 87.849
	0.107	*0.093*	*0.127*	*− 1.594*	*66.501*
Private	0.033***	0.024***	0.021***	3.099***	
	0.002	*0.001*	*0.002*	*3.522*	
Govt	− 0.022	− 0.056	− 0.054	− 30.921	− 36.931
	0.06	*0.063*	*0.062*	*− 1.054*	*29.257*
Foreigners	− 0.307		0.089	167.424	
	0.231		*0.218*	*1.625*	
Mercosur	0.002		− 0.185	− 27.390	
	0.169		*0.214*	*− 0.2661*	
Pop			0.03***	15.859***	1.252
			0.009	*2.768*	*6.212*
WTO	0.116		0.166	− 45.293	
	0.245		*0.22*	*− 0.438*	
Import				7.002*	6.39*
				1.803	*3.797*
Export				− 6.828*	− 18.109***
				− 1.671	*4.23*
FDI_Abroad				0.019	
				1.135	
FDI_IN			0***	0.009	0.016**
			0	*1.111*	*0.007*
CAN	− 0.279**				
	0.129				
Island	− 0.166				
	0.103				
South	0.117				
	0.118				
GDP_PPP					3.287***
					0.473
LSDV R-squared		0.55	0.56	0.3	0.29
LSDV F(38, 1005)		41.55	37.8	10.68	11.9
P-value(F)	3.00E-124	1.10E-148	6.20E-153	3.90E-50	1.07E-51
Within R-squared	0.45*	0.28	0.3	0.13	0.13

countries.

Alternative models have been estimated without Brazil (being a potential outlier in the estimations) and only considering Mercosur. While the overall robustness of the estimation is affected by these operations, it is quite interesting to note a few peculiar results of these further analyses. First of all, considering only the Mercosur countries, main relationships are confirmed with all of the main elements that are statistically significant. Moreover, exports and FDIs abroad increase their negative effects in terms of PPI attractiveness with an increasing effect of private participation. Eventually, Table 4 shows the results removing just Brazil from the sample of considered countries: the table shows the model 1, 4, 6, 7. The models show an increasing (positive) impact of FDI in the reported economies (FDI_in the shown models) and of private participation, underlining the role of the specific policies in promoting such kinds of collaborative projects. Interestingly, while the reduced statistical significance of such results affect the possibility to generalize these alternative model conclusions, it is important to underline that all main results are confirmed. The only difference seems to be the change of sign in the variable “govt” related to the specific political parties governing the country. This might be related to the specific industrial structure of Brazil (with many project partially funded by public owned conglomerates) that generate distortions in terms of the link between a given political strategy and the related PPP investments.

7. Conclusions

The current study aimed at investigating the effects of institutions on transport investments and the development of the transport network in Latin America and the Caribbean. The literature unanimously shows that market openness and other government decisions are important factors in fostering economic development (e.g. Wacziarg and Welch, 2008). Nevertheless, not many studies focused their attention on transport policies and the institutional environment (e.g. Ng et al., 2013). The current research offers a contribution to fill this gap, investigating a particular vehicle for implementing transport projects: the PPIs. As previously discussed, PPIs are used worldwide to promote transport investments in developing countries, and Latin American and the Caribbean are not exceptions. These PPIs helped in fostering international collaboration, transforming the Latin American and Caribbean transport system over the last 3 decades. The introduction of such an investment promoted new forms of collaboration within and outside the region, influencing the organisation of the transport system.

Addressing the relationships among PPIs to both economic and institutional variables allowed us to better understand the relationship among government choices (e.g., the presence in regional organisations, the possibility for foreign investors to operate in the markets and private participation), economic variables (e.g., imports and exports) and transport network development.

This relationship showed a clear link between certain government strategies (e.g., participation in regional organisations and the promotion of private investors) and the related outcome in terms of transport investments. In particular, it is interesting to note the positive (and significant) impact of being part of a regional organisation (e.g., Mercosur), as well as involving private companies. On the opposite side, a negative effect can be created, attracting foreigner companies. Moreover, the differences in the estimation of the number of investments and the value suggest that the size of the investment might modify those preferences to achieve particular (national) goals.

An interesting, even if only briefly mentioned, issue is the timescale of the intervention. Even if the variable representing national governments was not significant in the quantitative analysis, it is a matter of fact that such kinds of policies characterised conservative governments with a specific time scale plan (i.e., first international nodes and then internal networks) in the 1980s; however, in the last 15 years, these measures have been supported by any government, despite its political view, and they differ with the specific needs of the country (e.g., differentiation between exporting countries and importing countries).

The authors are aware that the performed analysis presents some limitations due to the accuracy of the dataset and the possibility to enlarge the set of econometric models tested. Nevertheless, the results obtained seem interesting and further help to better understand the link between specific transport policies and the regional network development. Hopefully, these results will encourage further developments to check if similar results also characterise different regions in other continents and to better evaluate the effects of the several regional organisations on the development of infrastructure endowment. As part of this attempt, it is interesting noticing how both regional logistics performance reports (e.g. Logistics Performance Index [WB, 2017]) as well as some recent research study (e.g. Ng et al., 2013; Wilmsmeier and Martinez-Zarzoso, 2010) underline how the performance of the transport system in Latin American and Caribbean countries is often related to the governance of existing as well as new infrastructure and not just the provision of them. Thus, further research will focus on better understanding the effects of transport network governance (e.g. management models) as well as government incentives on the spatial distribution and performance of the studied infrastructure.

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